

Pennsylvania.—Philadelphia, 1st; East Brook, 1st, 28th; Dyberry, 2d; Wellsborough, 14th, 26th.

South Carolina.—Stateburg, 2d, 20th, 21st; Spartanburg, 14th.

Tennessee.—Nashville, 24th, 31st.

Texas.—Galveston, 12th, 13th, 19th, 22d.

Vermont.—Lunenburg, 7th; Poultney, 9th; Strafford, 29th.

Virginia.—Lynchburg, 4th, 21st, 27th; Variety Mills, 15th; Dale Enterprise, 26th, 29th.

Washington Territory.—Bainbridge Island, 31st.

Wisconsin.—Milwaukee, 27th.

Wyoming.—Fort Bridger, 11th, 21st, 24th.

LUNAR HALOS.

Lunar halos were observed in the various states and territories during the month, as follows:

Alabama.—Montgomery, 8th, 9th.

Arizona.—Willcox, 16th.

California.—Sacramento, 12th.

Colorado.—Pike's Peak, 14th.

Connecticut.—New London, 17th.

Florida.—Key West, 7th, 8th, 10th; Sanford, 9th, 16th; Jacksonville, 10th, 12th; Limona, 17th.

Georgia.—Atlanta, 6th; Augusta, 10th, 12th; Savannah, 11th.

Illinois.—Pekin and Springfield, 9th.

Indiana.—Jeffersonville, 9th, 10th, 11th, 13th; Vevay, 10th, 13th; Terre Haute, 12th.

Kansas.—Wyandotte, 7th, 8th; El Dorado, 7th, 22d.

Kentucky.—Frankfort, 10th, 12th; Louisville, 11th.

Louisiana.—New Orleans, 10th, 13th.

Maine.—Portland, 9th, 25th.

Massachusetts.—Boston, 21st, 25th.

Michigan.—Lansing, 8th.

Nebraska.—North Platte, 9th, 11th; De Soto, 13th.

New Hampshire.—Nashua, 9th, 21st, 25th.

New York.—Setauket, 8th.

North Carolina.—New River Inlet, 13th; Kitty Hawk, 17th.

Ohio.—Tiffin, 8th; Cincinnati, 12th; Garrettsville, 24th.

Oregon.—East Portland, 17th.

South Carolina.—Spartanburg, 13th.

Tennessee.—Knoxville, 7th, 8th; Nashville, 12th, 18th, 19th.

Texas.—Palestine, 6th, 9th, 16th; Indianola, 7th, 8th, 11th, 13th to 18th; Brownsville, 9th; San Antonio, 13th.

Utah.—Frisco, 17th.

Virginia.—Bird's Nest, 6th, 7th, 12th, 13th; Wytheville and Dale Enterprise, 9th; Rappahannock Station, 9th, 11th; Lynchburg, 10th, 13th, 14th; Variety Mills, 11th.

West Virginia.—Clarksburg, 7th; Parkersburg, 7th, 13th.

Wyoming.—Fort Bridger, 10th, 15th.

The phases of the moon (Washington mean time) during July, as given in "The American Ephemeris and Nautical Almanac" for 1886, are as follows: New moon, 1st, 4 h. 58.4 m., and 30th, 12 h. 17.7 m.; first quarter, 7th, 20 h. 9.9 m.; full moon, 15th, 10 h. 0.7 m.; last quarter, 23d, 14 h. 13.1 m.; apogee, 18th, 13.6 h.; perigee, 3d, 0.0 h., and 31st, 5.9 h.

MIRAGE.

Indianola, Texas, 12th, 13th.

Oswego, New York, 22d.

Duluth, Minnesota, 9th.

Webster, Dakota, 6th.

Salina, Kansas, 27th.

Reidsville, North Carolina, 30th.

MISCELLANEOUS PHENOMENA.

DROUGHT.

During July a very disastrous drought prevailed over Iowa, Illinois, Dakota, and Minnesota, as well as over the greater part of Wisconsin, Nebraska, Kansas, and Texas. The dry weather commenced in May, and during June and July had become a severe drought, inflicting large losses on the grain-growing interests in the Northwest and the cattlemen in Texas.

During the first six days of the month very high temperatures occurred in the northern districts, especially in Dakota on the 6th, which added materially to the injurious effects of the dry weather. In New England also the effect of dry weather could be seen in the brown dry grass and short crops. All the rivers were low, especially the Connecticut and Merrimac, while a number of their tributaries had become nearly dry. Along the valleys of both these rivers a number of mills were obliged to suspend operations on account of the low water, and many persons were thrown out of employment. The following notes will serve to show the extent and severity of the drought:

Aberdeen, Brown county, Dakota, 4th: hot winds and unusually warm weather have prevailed in this vicinity for the past week, doing much damage to wheat. Farmers estimate that the yield will not be more than half the average crop, as very little rain has fallen during the past month.

Freeport, Stephenson county, Illinois, 6th: drought has prevailed in this vicinity during the past six weeks, and the ground has become very hard and dry. The growing crops are being stunted, and pasture land is becoming bare.

Huron, Dakota, 6th: the ground is quite dry, and grain and grass are suffering from the effects of the long continued dry weather.

Fort Worth, Texas, 7th: reports from various parts of the surrounding country state that the effects of the long drought in western Texas is unprecedented, in some localities no heavy rains have fallen during the past fourteen months.

Galena, Illinois: on the 9th the long-continued and disastrous drought in this section was broken by a rain, which thoroughly wet the ground and greatly benefited vegetation of every kind.

Albany, Shackelford county, Texas: on the 12th the northern part of Texas was visited by a heavy rain storm, which was of great benefit to farmers and cattlemen. During May, June, and the first decade of July very little rain had fallen, and the ground had become cracked and baked hard by the sun. Crops of all kinds, including grass on cattle ranges, were dead and dry. Cattle were reported to have been dying rapidly from lack of water and food.

Cedar Rapids, Iowa, 13th: reports from various points in Iowa show that crops will be short on account of the prevailing drought.

Bangor, Maine, 14th: drought in this section of the state has affected the hay crop, and only two thirds of the average yield will be secured. In Washington and Hancock counties as well as in various other parts of Maine, the injury has been greater and numerous wells and springs have become exhausted, while rivers as large as the Penobscot became so low as to interrupt logging operations. On the Mattawamkeag River 5,000,000 feet of logs were grounded.

Boston, Massachusetts, 15th: reports from the various farming districts of the state show that the crops are suffering severely from the effects of the drought. In Newburyport and along the Merrimac Valley thousands of acres of potatoes and corn are injured. The drought has inflicted severe losses on the Cape Cod cranberry farmers.

Grand Haven, Michigan, 15th: farmers say that the long continued dry weather has dried and killed the grass in pastures, and that the potato crop will be a complete failure.

Carson, Pottawattomie county, Iowa, 16th: drought has prevailed here during the past six weeks, and corn and other crops are suffering.

Dallas, Texas, 17th: the drought in western Texas has become very severe; cattle are dying from want of water and grass; stockmen are moving their herds into those counties that have not been so seriously affected.

Shawneetown, Gallatin county, Illinois, 20th: copious rain fell to-day, doing a great amount of good to corn, which had commenced to suffer from the drought.

Cape Girardeau, Cape Girardeau county, Missouri: this place was visited by a heavy fall of rain on the afternoon of the 20th, which was of great benefit to crops, no rain having fallen dur-

ing the past twenty-four days. Reports from various counties show that the rain was general throughout this section, and was of inestimable value to farmers whose crops had begun to feel the effects of the continued dry weather.

Elk Falls, Elk county, Kansas: on the 23d 1.22 inches of rain fell, breaking the drought which had considerably damaged corn and made the millet crop an entire failure. Grass was very short, and cattle were beginning to suffer from lack of food and water.

Lamar, Missouri; on the 24th two inches of rain fell and was of inestimable value to farmers. The dry weather which had prevailed in this section during June and July did great damage to crops; they were injured not only by the lack of rain, but by the chinch bug which breeds in this section in great numbers during dry weather, and during the present drought were unusually numerous and destructive, especially in wheat fields.

Fort Scott, Kansas: a heavy rain began falling on the morning of the 24th and continued throughout the day; after five weeks of continuous dry weather this rain was of great value to farmers. Reports from numerous places show that the rain extended over the greater part of the state.

Denver, Colorado: on the 25th heavy rain fell in the valley of the Platte River and over the plains to the eastward, breaking the long continued drought. Very little rain had fallen during the past three months, and water, even for domestic wants, had become scarce. All the smaller streams had become dry and rivers were very low.

Leavenworth, Kansas: on the 29th, after a drought of five weeks' duration, an abundant rain commenced falling and continued for several hours.

Madison, Wisconsin, 30th: this vicinity is suffering from the effects of the drought which has now lasted two months, the total rainfall for June and July being only 1.87 inches. In parts of Manitowoc county no rain fell from April 30th until the middle of July, the result is an almost total failure of crops. The observer at Embarras reports that swamps and brooks are dry and rivers very low; also that the drought is more severe than any that has happened during the past forty-three years.

Columbia, Miami county, Kansas: during the month very little rain fell in this county, and the effects of the drought were severely felt by farmers. Stock was suffering from want of both food and water. In this town wells and cisterns had become exhausted of their supply and the inhabitants were obliged to bring water from a distance.

Pentwater, Michigan, 30th: dry weather has prevailed in this section for over three months, greatly injuring all kinds of crops and killing many trees.

Mottville, Saint Joseph county, Michigan, 30th: streams and wells are lower than they have been for twenty years.

Vevay, Switzerland county, Indiana, 30th: the deficiency of rain during the month has injured the corn crop.

Cedar Rapids, Iowa: the month has been remarkable for the small amount of rainfall, 0.58 inch.

Wauseon, Fulton county, Ohio: the observer at this place reports as follows:

The drought, which has continued through the month, is the severest in many years. In many places the ground is cracked eighteen inches to two feet deep, and one to two inches wide. Pastures are burned up, and meadows are brown as in the fall. Many farmers are compelled to feed their cattle. Corn is the only thing that seems to grow, and it must have rain soon or it cannot ear. There is much complaint of wells and cisterns being dry.

The monthly precipitation, 0.31 inch, is 4.01 inches less than the average for fourteen years. The largest July rainfall of that period, 7.26 inches, occurred in 1872; the smallest, previous to this year, 1.60 inches, in 1875. The total precipitation of the seven months of this year, 13.38 inches, is 10.14 inches less than the average for that time, and the least I have recorded.

The following is an extract from a description of the drought in Iowa, furnished by Gustavus Hinrichs, M. D., director of the "Iowa Weather Service":

Since the middle of May Iowa has been subjected to a drought, the most severe on record. Fortunately, the greater part of the state has been favored

with rains sufficient to break the drought temporarily toward the close of June.

* * * * *

The drought at Iowa City.

In the early summer of 1886 the last good rain fell on May 13th. Since that time we have had no rain reaching half an inch until August 4th. Thus we had no serviceable shower for eighty-three days! The total rains which fell in this interval were 0.02 inch during the last decade of May; 0.41 during the first, 0.17 during the second, and 0.25 during the third, decade of June. During the entire month of July we had only one-tenth of an inch of rain here. The total rainfall during the eighty-three days of our drought was 0.95 inch only. The normal rainfall for this part of our season is 10.92 inches. Our pastures have been brown for a long time, and burn readily from sparks of passing trains, unless cropped bare by stock. Meadows yielded a good crop of most excellent hay, due to early rains, but the stubble remains brown and looks dead. A great deal of corn is stunted and cannot yield much of a crop, and where no ears have formed, will yield but little fodder. Small grain, especially oats, are good in grain, and yield fair to good, where sown early to be developed by the spring rains; in that case the straw is good too, and thus will be quite an item in this winter's feed. It will be seen that even here, where the drought is extreme, there is not a failure of crops, because our farming operations are sufficiently diversified to make a total failure almost an impossibility.

The belt of continuous drought.

A belt running diagonally from northwest to southeast through Iowa marks the region of greatest drought in the state, because no rain fell in this belt amounting to one inch during any ten days of this drought. From Marshall county a branch of this belt goes east over Iowa and Johnson to Scott county. Throughout this forking belt the drought has been the most severe, because continuous. In area this comprises probably one-tenth of the entire state. The description given above of the drought at Iowa City will apply more or less to all parts of this belt.

EARTHQUAKES.

Sau Francisco, California: on the 2d, at 3.30 a. m. (75th meridian time), a shock of earthquake was felt in this city. The vibration was from north to south, and continued about five seconds. The shock was also felt at Stockton, Redwood City, and numerous other places in the interior.

Malaga, Spain: a shock of earthquake was felt here on the 7th.

FOREST AND PRAIRIE FIRES.

Mackinac, Mackinac county, Michigan: destructive forest fires were burning along the line of the Detroit, Mackinac, and Marquette Railroad on the 6th. At Newberry, 30,000 cords of wood were burned on the 5th.

Lancaster, New Hampshire: on the 7th, after several weeks of drought, fire started in the forest near this place and spread with great rapidity. Several hundred acres of land were burned over, destroying property valued at from \$50,000 to \$70,000. Included in the losses were one and a half miles of the Zealand Valley Railroad, two long trestles, two million feet of spruce timber ready for shipping, and a number of cars.

Milwaukee, Wisconsin: on the 7th a fire broke out in the woods near Romeo, a station on the Wisconsin Central Railroad, and, communicating with a lumber yard, spread rapidly, destroying the entire village. A saw mill, a planing mill, and five million feet of seasoned lumber were also burned. At Embarras and numerous other places throughout the state very destructive forest fires occurred at different times during the month. Owing to the dry weather the woods burned rapidly and great quantities of valuable timber were lost.

Jamaica, Windham county, Vermont: on the 8th a forest fire occurred in the mountains near this place, and, owing to the continued dry weather, the fire spread rapidly. A large number of railroad ties, 1,500 cords of wood, and many cords of bark were burned.

Erie, Erie county, Pennsylvania: on the 9th extensive forest fires were burning near Albion, in this county.

Thurston, Steuben county, New York: on the 10th, after a month of drought, the forests in this vicinity were ignited by passing railroad trains and many acres of valuable timber were burned. The fire spread into fields of grain, causing great loss to farmers.

Chemung, Chemung county, New York, 11th: at Wynkoop Creek, four miles from this place, forest fires have been burning for several days. A valuable track of timber land was

burnt as was also several farm houses and many fields of grain.

Morley, Lincoln county, Wisconsin: on the 16th extensive forest fires prevailed in this vicinity. A number of large sheds stored with shingles and lumber were burned, also a large warehouse, entailing a loss of \$18,000.

Bangor, Maine: on the 16th extensive forest fires were burning along the line of the Mount Desert Railroad.

Howard City, Montcalm county, Michigan, 17th: the drought in this section continues, and forest fires are destroying much valuable timber and farm property. On the 16th two farm houses, south of the town, were burned, together with a large amount of grain and stock.

Muskegon, Muskegon county, Michigan, 17th: during the past twenty-four hours the town has been enveloped in smoke from fires in the surrounding forests. Farmers and lumbermen in Twin Lakes, Holton, Whitehall, Fruitport, North Holland, and other towns in this part of the state, have suffered serious losses from fire.

Florence, Florence county, Wisconsin, 17th: the drought in this section has been severe since the middle of June, and on the 17th widespread forest fires prevailed. Lumbermen estimate that 100,000,000 feet of pine were burned in the Menominee region alone.

Muskogee, Indian Territory, 17th: the continued drought has withered and dried the prairie grass, and in several parts of this section extensive prairie fires have been burning for several days.

Escanaba, Michigan: extensive forest fires prevailed in this vicinity from the 3d to the 18th. The fires were extinguished by heavy rain on the 19th.

Forest and prairie fires have also been reported from the following places:

Portland, Maine: forest fires, 12th, 13th, 14th, 15th.

Marquette, Michigan: forest fires, 5th, 7th to 10th, 16th, 19th.

Mottville, Michigan: forest fires, 1st to 7th, 11th, 15th to 18th, 22d.

Grand Haven, Michigan: forest fires, 4th to 11th, 15th, 18th, 20th to 25th, 29th.

Fort Buford, Dakota: forest fire, 27th; prairie fires, 13th, 16th, 18th to 24th.

Humphrey, New York: forest fire, 5th.

North Platte, Nebraska: prairie fires, 14th, 15th.

Fort Assinaboine, Montana: prairie fires, 16th, 17th, 18th.

Fort Maginnis, Montana: forest fire, 15th.

Fort Shaw, Montana: prairie fire, 22d.

Pike's Peak, Colorado: prairie fires were seen from this station on the 11th.

Fort Bridger, Wyoming: forest fires, 4th.

Fort Spokaue, Washington Territory: prairie fires, 17th, 19th, 31st.

Portland, Oregon: forest fires, 29th.

Roseburg, Oregon: forest fire, 30th.

Bandon, Oregon: forest fires, 19th, 20th.

La Grange, Oregon: forest fires, 26th, 31st.

Mount Angel, Oregon: forest fires, 17th, 23d.

East Portland, Oregon: forest fires, 15th to 19th, 28th, 29th, 30th.

INSECTS.

Utica, New York, 14th: reports from various localities in the hop producing region of central New York indicate that hop lice and honey dew have committed great injury to the vine. In Waterville the crop has been seriously injured by insects, and farmers say that they will have only half the average crop. In North Brookfield the crop has been almost entirely destroyed.

Yates Centre, Woodson county, Kansas, 30th: the month has been very warm and dry, very little rain falling from the 10th of June until the 20th of this month. During this drought the chinch bug increased very rapidly and was very injurious to crops, especially to corn, the yield of which will be reduced probably fifty per cent.

METEORS.

Roseburg, Oregon: a meteor was observed at 12.25 a. m. of the 17th; it was about eight inches in diameter and moved in a sinuous course, leaving a trail of yellowish white light 10° in length. The meteor exploded, when 10° west of north, at an altitude of 20°, and luminous fragments were thrown off in all directions.

Davenport, Iowa: on the 17th, at 1.20 a. m., a very bright meteor, about the size of a man's head, appeared in the southwestern sky, moving in a northeasterly direction. When near the zenith it burst with a report similar to that of a rocket.

East Portland, Oregon: on the 17th, at 9 p. m., a large meteor fell; it was of a pale green color, and cast light sufficient to illuminate surrounding objects.

Huron, Dakota: at 10.30 p. m. of the 26th a large meteor was seen near the zenith, from which it passed toward the northeast and exploded when about 10° from the horizon.

Meteors were also reported, as follows:

Arizona.—Yuma, 5th, 24th; Prescott, 24th.

Arkansas.—Lead Hill, 12th, 29th.

Colorado.—Montrose, 25th.

Connecticut.—New Haven, 4th.

Dakota.—Webster, 30th.

Florida.—Key West and Limona, 26th.

Illinois.—Windsor, 27th; Charleston, 31st.

Iowa.—West Union, 5th; Cedar Rapids, 12th, 26th to 31st; Clinton, 26th, 28th, 29th.

Massachusetts.—Boston, 11th; Provincetown, 24th.

Montana.—Fort Assinaboine, 27th.

New Jersey.—Beverly, 6th.

New York.—North Volney, 22d; Mountainville, 22d, 23d, 27th; Menand's Station, 31st.

North Carolina.—Smithville, 29th.

Ohio.—Tiffin, 31st.

Oregon.—Bandon, 17th.

Pennsylvania.—Pittsburg, 26th; Dyberry, 27th.

South Carolina.—Stateburg, 23d.

Tennessee.—Nashville, 27th, 28th.

Virginia.—Variety Mills, 31st; Wytheville, 23d, 27th, 28th.

POLAR BANDS.

Polar bands were reported during the month from the following stations:

El Paso, Texas, 21st, 27th.

Riley, Illinois, 23d.

Salina, Kansas, 27th.

Ninnescah, Kansas, 1st, 10th, 29th.

Somerset, Massachusetts, 12th.

Syracuse, New York, 1st.

Napoleon, Ohio, 3d, 9th.

Wytheville, Virginia, 26th, 30th.

Dale Enterprise, Virginia, 30th.

Prairie du Chien, Wisconsin, 25th, 27th, 28th, 31st.

SAND STORMS.

El Paso, Texas, 12th, 19th, 26th.

Yuma, Arizona, 9th, 10th, 13th, 15th.

Fort McDowell, Arizona, 7th, 8th, 9th, 13th.

Fort Yates, Dakota, 29th.

SUNSETS.

The characteristics of the sky, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from one hundred and sixty-five stations show 5,108 observations to have been made, of which one was reported doubtful; of the remainder, 5,107, there were 4,364, or 85.5 per cent., followed by the expected weather.

SUN SPOTS.

Mr. H. D. Govey, of North Lewisburg, Champaign county, Ohio, reports having observed sun spots on the following dates: 1st, 2d, 3d, 5th to 9th, 16th, 17th, 19th, 21st to 24th, 27th, 28th, 31st.

Prof. L. G. Carpenter, of the Michigan Agricultural College, Lansing, furnishes the following record of sun spots for July, 1886: 5th, 4 p. m., four groups, twenty-six spots; 10th, faculae; 17th, 3.40 p. m., two groups, eighteen spots; 23d, 3.30 p. m., three groups, twenty-six spots; 28th, 3.30 p. m., four groups, twenty-four spots; 31st, 4.15 p. m., four groups, thirty-six spots.

Prof. David P. Todd, director of the Lawrence Observatory, Amherst, Massachusetts, furnishes the following record of sun spots for July, 1886:

Date— July, 1886. Standard time.	No. of now.		Disappeared by solar rotation.		Reappeared by solar rotation.		Total No. visible.		Remarks.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
1, 6 p. m...	0	0	0	0	0	0	3	50†	
3, 11 a. m...	0	0	0	0	0	0	3	65†	
4, 4 p. m...	0	5†	0	0	0	0	3	45†	
5, 9 a. m...	0	5†	0	0	0	0	3	50†	
22, 2 p. m...							2	25†	
25, 5 p. m...							3	15†	
27, 11 a. m...	2	25†	1	5			4	40†	
28, 9 a. m...	0	0	0	0	0	0	4	45†	
29, 5 p. m...	0	0	0	0	0	0	4	45†	
31, 2 p. m...	0	0	0	0	0	0	4	50†	

Faculae were seen at the time of every observation. †Approximated.

WATER-SPOUTS.

The schooner "Douglas Hovey," Captain Wright, reports seeing three large water-spouts on July 6th, at 6 p. m., when about twenty miles southeast of Cape Hatteras, North Carolina.

Key West, Florida: at 7 p. m. of the 26th a water-spout formed in the bay, about half a mile from the town.

The observer at Pensacola, Florida, reports, as follows, in regard to an unusual phenomenon which occurred at that place on the 13th:

At 3.50 p. m. a revolving column of smoke, between one and two miles distant and moving eastward, was seen to the east of the station. The altitude of the upper end was about 40°; that of the lower end about 20°. The clouds north of the column were moving from the north; those south, from the southwest. The upper end of the column was inclined toward the north at an apparent angle of 30° from the vertical; the phenomenon continued several minutes.

VERIFICATIONS.
INDICATIONS.

The detailed comparison of the tri-daily indications for July, 1886, with the telegraphic reports for the succeeding thirty-two hours, shows the general average percentage of verifications to be 71.93. The percentages for the different elements are: Weather, 69.35; wind, 65.04; temperature, 76.88. By states, etc., the percentages are: For Maine, 68.35; New Hampshire, 68.89; Vermont, 72.58; Massachusetts, 69.18; Rhode Island, 65.13; Connecticut, 67.92; New York, 73.48; Pennsylvania, 67.29; New Jersey, 69.53; Delaware, 67.29; District of Columbia, 65.50; Maryland, 69.89; Virginia, 70.16; North Carolina, 71.15; South Carolina, 69.89; Georgia, 73.12; Florida, 67.38; Alabama, 71.42; Mississippi, 71.16; Louisiana, 75.63; Texas, 70.79; Arkansas, 70.07; Tennessee, 68.19; Kentucky, 75.18; Ohio, 74.46; West Virginia, 62.19; Indiana, 74.37; Illinois, 74.73; Michigan, 76.08; Wisconsin, 68.82; Minnesota, 67.39; Iowa, 70.68; Kansas, 69.96; Nebraska, 71.15; Missouri, 76.61; Colorado, 69.62; east Dakota, 66.40.

There were twenty-six omissions to predict, out of 9,951, or 0.26 per cent. Of the 9,925 predictions that have been made, seven hundred and ninety-one, or 7.97 per cent., are considered to have entirely failed; six hundred and eighty-five, or 6.90 per cent., were one-fourth verified; 2,274, or 22.91 per cent., were one-half verified; 1,978, or 19.93 per cent., were three-fourths verified; 4,197, or 42.29 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

The following extracts, relative to the method of verifying the forecasts of the Signal Service, from the official instructions governing the Indications Division, Office of the Chief Signal Officer, are published for the information of those interested:

In determining the percentages of verification of predictions, the conditions occurring during the twenty-four hours predicted for, as shown by the charts for the 2d, 3d, and 4th reports, following the report on which the pre-

dition was made, will be carefully examined by the verifying officer, who will ascertain whether the conditions predicted for each state or territory, or part of state or territory, have prevailed in it to the amount of one-fourth, one-half, three-fourths, or the entire area under consideration. The area for which the prediction is made will be considered in verifying weather and temperature; any fraction of area less than one-quarter will be rated one (1); over one-quarter and less than one-half, two (2); over one-half and less than three-quarters, three (3); and over three-quarters, four (4). The barometer indications will not be verified, as the prediction is left optional with the Indications Officer.

In determining the percentage of verification of predictions of wind-direction the verifying officer will note the directions reported on the three charts to which the prediction applies, and will ascertain whether the directions observed fulfill the prediction, as follows: If the direction predicted is observed at one-quarter of the observations reported from the stations on the three charts under consideration the percentage of verifications will be rated one (1); over one-quarter and less than one-half, two (2); over one-half and less than three-quarters, three (3); and over three-quarters, four (4).

In determining the total monthly percentages of verifications for all the predictions, the percentage of verification for each state for weather will be multiplied by five; for temperature, by four; and for wind-direction, by one; the sum of all these will be divided by ten.

CAUTIONARY SIGNALS.

During July, 1886, twenty-seven signals of various kinds were ordered, of which number, five, or 18.52 per cent., were fully justified both as to direction and velocity. Of the above signals, eleven were ordered for northeasterly winds; of these, three, or 27.27 per cent., were justified both as to direction and velocity, and three, or 27.27 per cent., were justified as to velocity only. Four signals were ordered for southeasterly winds, of which none were justified both as to direction and velocity, two, or 50.00 per cent., were justified as to velocity only. Eight signals were ordered for southwesterly winds, and two, or 25.00 per cent., were justified both as to direction and velocity. Four signals were ordered for northwesterly winds; of these, none were justified.

In twenty-six cases winds occurred which would have justified cautionary signals had they been displayed, and in twenty-seven cases winds occurred which would have justified the display of on-shore signals.

RAILWAY WEATHER SIGNALS.

Prof. P. H. Mell, jr., director of the "Alabama Weather Service," in the report for July, 1886, states:

The verification of predictions for the whole area was 94 per cent. for temperature, and 90 per cent. for weather.

The following corporations comprise this system: South and North; Montgomery and Mobile; Mobile and Girard; Georgia Pacific; East Tennessee, Virginia and Georgia system in Alabama; Memphis and Charleston; Columbus and Western; Atlanta and West Point of Georgia; Northeastern of Georgia; Western and Atlantic; East Tennessee, Virginia and Georgia system in Georgia; Montgomery and Eufaula; Pensacola and Selma; Pensacola and Atlantic; the cities of Milledgeville, Georgia, and Talladega, Alabama.

LOCAL WEATHER SIGNALS.

Prof. Goodwin D. Swezey, director of the "Nebraska Weather Service," in the report for July, 1886, makes the percentage of verifications for temperature in the state 88.7, and weather 71.5.

Prof. Winslow Upton, director of the "New England Meteorological Society," in the report for July, 1886, states:

The verification of weather signals at New Haven was 94 per cent. for temperature, 77 for weather; at twelve stations reporting to the secretary, 94.6 for temperature, 79.8 for weather. Local predictions made at Blue Hill in the morning for sixteen hours were 90 per cent. verified, and at sunset for thirty hours were 84 per cent. verified.

J. D. Plunkett, M. D., President of the Tennessee State Board of Health, in the bulletin for July, 1886, gives the following table of verification of weather signals:

Stations.	Temperature.	Weather.	Stations.	Temperature.	Weather.
	Per cent.	Per cent.		Per cent.	Per cent.
Nashville.....	90.3	83.9	Shelbyville.....	54.8	54.8
Jackson.....	89.3	64.5	Fayetteville.....	93.5	74.2
Milan.....	87.1	61.3	Athens.....	100.0	96.8
Trenton.....	100.0	74.2	Springfield.....		96.8
Clarksville.....	74.2	42.0	Johnson City.....	83.9	67.8
Gallatin.....	100.0	67.7	Lexington.....	93.5	77.4
Murfreesborough.....	90.0	73.3	London.....	96.8	74.2

Average for state, temperature, 89.3; weather, 69.0 per cent.